Chemistry 129.01, Spring 2017, General Chemistry

Final Exam: Wednesday, May 17 at 2pm
S-2243

Topics you should be familiar with:

GREENHOUSE GAS MODULE

STOICHIOMETRY
a. Balancing Equations
b. Converting grams to moles, moles to grams
c. Atomic mass units, molar mass
d. Empirical analysis (may not always involve "nice round" numbers)

STRUCTURE OF THE ATOM
a. Be familiar with the electromagnetic spectrum, Line Spectra
b. Determining wavelength of electromagnetic radiation given its frequency or energy.
c. Atomic Structure
    Cathode ray expt (Thompson)
    Evidence electrons charge (Millikan)
    Evidence of dense nuclei (Rutherford)
d. Determining electrons/neutrons/protons in a given element/ion

PERIODIC TABLE
a. Properties and reactivity similar by column.
b. Metals form cations, Non-Metals form anions
c. Identify and name simple ionic and molecular compounds

LEWIS STRUCTURES
a. Non-ionic compounds form covalent complexes by sharing electrons
b. Counting valence electrons
c. Formal charge
d. Oxidation Numbers (elements reduced or oxidized in chemical reactions, oxidizing and reducing agents)

MOLECULAR GEOMETRY
a. Electrons repel one another, adopt geometry to minimize repulsion(VSEPR)
b. Be able to assign geometries and bond angles for central atoms with 2-6 things around them.
c. Predict dipole moment.

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ATOMIC STRUCTURE AND ENERGETICS

a. Bohr model of the hydrogen atom.
b. Wave/quantum behavior of matter explains line spectra
c. Energy level changes in hydrogen atom (absorption/emission)
d. Quantum numbers: n,l,m (meaning and allowed values)
e. Spatial representations of orbitals (l)
f. Electron configurations in atoms (filling of orbitals), orbital diagrams
    --Pauli Exclusion Principle, Hund's rules

PERIODIC PROPERTIES

a. Trends in atom/ion sizes, ionization energies and metallic character
    i. --role of shielding
b. Trends in group reactivity

CHEMICAL BONDING

a. Covalent bonding, strengths of bonds
b. Hybrid Orbital theory
c. Assigning hybridization knowing geometry
d. Molecular Orbital Theory
    i. Predict magnetic properties, bond order, bond strengths

OXIDATION NUMBERS

a. Determine the oxidation numbers of elements.
b. Identify elements as reduced or oxidized in chemical reactions

INTERMOLECULAR FORCES, AND LIQUIDS

a. Differences between gases, liquids and solids
b. Intermolecular forces
    i. Ion-dipole forces, dipole-dipole forces, hydrogen bonding, and London dispersion forces
    ii. Know relative strengths and effect on phase changes.
c. Liquid Properties
    i. Viscosity, surface tension, capillary action
d. Phase Changes and phase diagrams
    i. Exothermic or Endothermic?
    ii. Vapor Pressure

SOLUTIONS

a. What is a solution?
    i. Solvent, solute
    ii. How do solutions form?, role of intermolecular forces.
b. Factors affecting solubility
    i. Intermolecular forces, temperature, pressure

ii. Gases
iii. Solids

c. Saturated, unsaturated and supersaturated solutions and solubility
d. Concentration (Molarity, dilutions)

CHEMICAL EQUILIBRIUM

a. Equilibrium Constant Expression (Homogeneous and Heterogeneous Equilibria)
b. Interpreting, and Calculating Equilibrium Constants
c. Predicting the Direction of Reaction
d. Calculating Equilibrium Concentrations
e. Le Châtelier's Principle

ACID-BASE EQUILIBRIUM

a. Weak acids
    i. Calculate K_a from pH, percent ionization, calculate pH using K_a
b. Weak bases
c. Acid-Base Behavior and Chemical Structure (worksheet answered in class with the acid program)
d. Acid-Base properties of salt solutions.

BUFFERS AND TITRATIONS

b. The common-ion effect
c. Buffered Solutions
    i. Composition and action of buffer solutions, calculate pH of a buffer, addition of strong acids or bases to buffers.
d. Acid-Base Titrations
    i. Strong acid – strong base titrations, weak acid – strong base titrations, weak base – strong acid titrations, calculate pH at different points in a titration.

THERMOCHEMISTRY

a. Properties of state functions, sign conventions (exothermic, endothermic)
    i. First law of thermodynamics, internal energy, enthalpy
b. Heat Capacity (C_m, C_s) and calorimetry
c. Hess's Law
d. Enthalpy diagrams and standard heats of reaction from heats of formation.

CHEMICAL THERMODYNAMICS

a. Entropy and spontaneous processes
    a. Second and third laws of thermodynamics
    b. Standard Entropy Change
b. Predict how the entropy of the system will change with a change in temperature, volume, number of gas molecules and phase change.

c. Gibbs Free Energy
    i. Spontaneity
    ii. Equilibrium Constant
    iii. Standard Free Energy Change